

CLAIMS

1. An image matching system for retrieving a reference image similar to an input image, the image matching system comprising:
- means for making a match between the input image and a plurality
5 of representative three-dimensional object models;
 - means for making a match between the reference image and the representative three-dimensional object models; and
 - means for retrieving the reference image similar to the input image by using a result of the match between the input image and the
10 representative three-dimensional object models and a result of the match between the reference image and the representative three-dimensional object models.
2. The image matching system according to claim 1, further comprising:
- 15 means for finding a reference three-dimensional object model associated with the reference image similar to the input image; and
 - means for newly retrieving the reference image similar to the input image by using the reference three-dimensional object model and the input image.
- 20 3. The image matching system according to claim 1, further comprising:
- means for finding a reference three-dimensional object model associated with the reference image similar to the input image;
 - conversion means for squaring an input condition of the input image
25 with that of the reference image by converting the input image and/or the reference image on the basis of the reference three-dimensional object model; and

means for retrieving the reference image associated with the input image by making a match between the input image and reference image squared in input condition.

4. The image matching system according to claim 3, wherein the
5 conversion means previously converts the reference image, and squares an input condition of the input image with that of the reference image.

5. The image matching system according to claim 1, comprising:
image input means for inputting the input image;
a representative three-dimensional object model storage section for
10 storing a plurality of representative three-dimensional object models;
image generation means for generating at least one comparison image close in input condition to the input image every representative three-dimensional object model on the basis of the representative three-dimensional object models stored in the representative three-dimensional
15 object model storage section;

image matching means for calculating a similarity between the input image and each of the comparison images generated by the image generation means, selecting a maximum similarity with respect to comparison images associated with each representative three-dimensional
20 object model, and regarding the maximum similarity as a similarity between the input image and the representative three-dimensional object model;

a reference image storage section for storing the reference images of
objects;
25 a reference image matching result storage section for storing similarities between the reference images stored in the reference image

storage section and representative three-dimensional object models stored in the representative three-dimensional object model storage section; and

result matching means for extracting the reference image similar to the input image on the basis of similarities between the input image and the
5 representative three-dimensional object models calculated by the image matching means and similarities between the reference images and the representative three-dimensional object models stored in the reference image matching result storage section.

6. The image matching system according to claim 5, further
10 comprising:

three-dimensional object model registration means for registering representative three-dimensional object models in the representative three-dimensional object model storage section;

reference image registration means for registering reference images
15 in the reference image storage section; and

reference image matching result update means for conducting calculation of the similarities using the image matching means, on a combination of a reference image and a representative three-dimensional object model newly generated by registration, when a new representative
20 three-dimensional object model is registered in the representative three-dimensional object model storage section by the three-dimensional object model registration means, or when a new reference image is registered in the reference image storage section by the reference image registration means, and adding a result of the calculation to results in the reference
25 image matching result storage section.

7. The image matching system according to claim 5, wherein

the image matching means calculates a similarity between the input image and a representative three-dimensional object model every partial region,

the reference image matching result storage section stores
5 similarities between the reference images stored in the reference image storage section and representative three-dimensional object models stored in the representative three-dimensional object model storage section, every partial region, and

the result matching means extracts the reference image similar to
10 the input image on the basis of similarities between the input image and the representative three-dimensional object models calculated by the image matching means every partial region and similarities between the reference images and the representative three-dimensional object models, stored in the reference image matching result storage section every partial region.

15 8. The image matching system according to claim 5, wherein
the result matching means calculates similarities between similarities between the input image and the representative three-dimensional object models and similarities between the reference images and the representative three-dimensional object models, and in the
20 calculation provides the resultant similarities with weights on the basis of candidate precedence of similarities between the input image and the comparison images and the representative three-dimensional object models.

9. The image matching system according to claim 2, comprising:
image input means for inputting the input image;
25 a representative three-dimensional object model storage section for storing a plurality of representative three-dimensional object models;

image generation means for generating at least one comparison image close in input condition to the input image every representative three-dimensional object model on the basis of the representative three-dimensional object models stored in the representative three-dimensional object model storage section;

image matching means for calculating a similarity between the input image and each of the comparison images generated by the image generation means, selecting a maximum similarity with respect to comparison images associated with each representative three-dimensional object model, and regarding the maximum similarity as a similarity between the input image and the representative three-dimensional object model;

a reference image storage section for storing the reference images of objects;

a reference image matching result storage section for storing similarities between the reference images stored in the reference image storage section and representative three-dimensional object models stored in the representative three-dimensional object model storage section;

result matching means for extracting the reference image similar to the input image on the basis of similarities between the input image and the representative three-dimensional object models calculated by the image matching means and similarities between the reference images and the representative three-dimensional object models stored in the reference image matching result storage section;

a reference three-dimensional object model storage section for storing reference three-dimensional object models associated with the reference images stored in the reference image storage section;

second image generation means for obtaining reference three-dimensional object models associated with reference images extracted from the result matching means, from the reference three-dimensional object model storage section, and generating at least one second comparison image close in input condition to the input image every reference three-dimensional object model on the basis of the obtained reference three-dimensional object models; and

second image matching means for calculating similarities between the input image and second comparison images generated by the second image generation means, selecting a maximum similarity from among second comparison images associated with each of the reference three-dimensional object models, and regarding the maximum similarity as a similarity between the input image and the reference three-dimensional object model.

10. The image matching system according to claim 9, further comprising:

three-dimensional object model registration means for registering representative three-dimensional object models in the representative three-dimensional object model storage section;

reference image registration means for registering reference images in the reference image storage section; and

reference image matching result update means for conducting calculation of the similarities using the image matching means, on a combination of a reference image and a representative three-dimensional object model newly generated by registration, when a new representative three-dimensional object model is registered in the representative three-dimensional object model storage section by the three-dimensional object

model registration means, or when a new reference image is registered in the reference image storage section by the reference image registration means, and adding a result of the calculation to results in the reference image matching result storage section; and

5 three-dimensional object model generation means responsive to registration of a similarity between the reference image and the representative three-dimensional object model in the reference image matching result storage section conducted by the reference image matching result update means, for generating the reference three-dimensional object
10 model associated with the reference image by combining the representative three-dimensional object models stored in the representative three-dimensional object model storage section on the basis of the similarity, and registering the generated reference three-dimensional object model in the reference three-dimensional object model storage section.

15 11. The image matching system according to claim 10, wherein the three-dimensional object model generation means generates a reference three-dimensional object model associated with each reference image by combining representative three-dimensional object models stored in the representative three-dimensional object model storage section every
20 partial region, on the basis of similarities obtained every partial region between reference images stored in the reference image storage section and representative three-dimensional object models stored in the representative three-dimensional object model storage section, and registers the generated reference three-dimensional object model in the reference three-dimensional
25 object model storage section.

12. The image matching system according to claim 9, wherein

the image matching means calculates a similarity between the input image and a representative three-dimensional object model every partial region,

the reference image matching result storage section stores
5 similarities between the reference images stored in the reference image storage section and representative three-dimensional object models stored in the representative three-dimensional object model storage section, every partial region, and

the result matching means extracts the reference image similar to
10 the input image on the basis of similarities between the input image and the representative three-dimensional object models calculated by the image matching means every partial region and similarities between the reference images and the representative three-dimensional object models, stored in the reference image matching result storage section every partial region.

15 13. The image matching system according to claim 9, wherein
the result matching means calculates similarities between similarities between the input image and the representative three-dimensional object models and similarities between the reference images and the representative three-dimensional object models, and in the
20 calculation, provides the resultant similarities with weights on the basis of candidate precedence of similarities between the input image and the comparison images and the representative three-dimensional object models.

14. The image matching system according to claim 3, comprising:
image input means for inputting the input image;
25 a representative three-dimensional object model storage section for storing a plurality of representative three-dimensional object models;

image generation means for generating at least one comparison image close in input condition to the input image every representative three-dimensional object model on the basis of the representative three-dimensional object models stored in the representative three-dimensional object model storage section;

image matching means for calculating a similarity between the input image and each of the comparison images generated by the image generation means, selecting a maximum similarity with respect to comparison images associated with each representative three-dimensional object model, and regarding the maximum similarity as a similarity between the input image and the representative three-dimensional object model;

a reference image storage section for storing the reference images of objects;

a reference image matching result storage section for storing similarities between the reference images stored in the reference image storage section and representative three-dimensional object models stored in the representative three-dimensional object model storage section;

result matching means for extracting the reference image similar to the input image on the basis of similarities between the input image and the representative three-dimensional object models calculated by the image matching means and similarities between the reference images and the representative three-dimensional object models stored in the reference image matching result storage section;

a reference three-dimensional object model storage section for storing reference three-dimensional object models associated with the reference images stored in the reference image storage section;

image conversion means for obtaining reference three-dimensional object models associated with reference images extracted from the result matching means, from the reference three-dimensional object model storage section, squaring an input condition of the input image with that of the reference image extracted by the result matching means by converting the input image and/or the reference image extracted by the result matching means, on the basis of the obtained reference three-dimensional object models, and generating partial images respectively of the input image and the reference image squared in input condition with each other; and
partial image matching means for calculating a similarity between the partial image of the input image and the partial image of the reference image generated by the image conversion means.

15. The image matching system according to claim 14, further comprising:

three-dimensional object model registration means for registering representative three-dimensional object models in the representative three-dimensional object model storage section;

reference image registration means for registering reference images in the reference image storage section; and

reference image matching result update means for conducting calculation of the similarities using the image matching means, on a combination of a reference image and a representative three-dimensional object model newly generated by registration, when a new representative three-dimensional object model is registered in the representative three-dimensional object model storage section by the three-dimensional object model registration means, or when a reference image is registered in the reference image storage section by the reference image registration means,

and adding a result of the calculation to results in the reference image matching result storage section; and

three-dimensional object model generation means responsive to registration of a similarity between the reference image and the
5 representative three-dimensional object model in the reference image matching result storage section conducted by the reference image matching result update means, for generating the reference three-dimensional object model associated with the reference image by combining the representative
10 three-dimensional object models stored in the representative three-dimensional object model storage section on the basis of the similarity, and registering the generated reference three-dimensional object model in the reference three-dimensional object model storage section.

16. The image matching system according to claim 15, wherein
the three-dimensional object model generation means generates a
15 reference three-dimensional object model associated with each reference image by combining representative three-dimensional object models stored in the representative three-dimensional object model storage section every partial region, on the basis of similarities obtained every partial region
between reference images stored in the reference image storage section and
20 representative three-dimensional object models stored in the representative three-dimensional object model storage section, and registers the generated reference three-dimensional object model in the reference three-dimensional object model storage section.

17. The image matching system according to claim 14, wherein
25 the image matching means calculates a similarity between the input image and a representative three-dimensional object model every partial region,

the reference image matching result storage section stores similarities between the reference images stored in the reference image storage section and representative three-dimensional object models stored in the representative three-dimensional object model storage section, every
5 partial region, and

the result matching means extracts the reference image similar to the input image on the basis of similarities between the input image and the representative three-dimensional object models calculated by the image matching means every partial region and similarities between the reference
10 images and the representative three-dimensional object models, stored in the reference image matching result storage section every partial region.

18. The image matching system according to claim 14, wherein the result matching means calculates similarities between similarities between the input image and the representative three-
15 dimensional object models and similarities between the reference images and the representative three-dimensional object models, and in the calculation, provides the resultant similarities with weights on the basis of candidate precedence of similarities between the input image and the comparison images and the representative three-dimensional object models.

20 19. The image matching system according to claim 1, wherein the object is a human face.

20. An image matching method for retrieving a reference image similar to an input image, the image matching method comprising:
a step of making a match between the input image and a plurality of
25 representative three-dimensional object models;

a step of making a match between the reference image and the representative three-dimensional object models; and

a step of retrieving the reference image similar to the input image by using a result of the match between the input image and the representative three-dimensional object models and a result of the match between the reference image and the representative three-dimensional
5 object models.

21. The image matching method according to claim 20, further comprising:

a step of finding a reference three-dimensional object model associated with the reference image similar to the input image; and
10 a step of newly retrieving the reference image similar to the input image by using the reference three-dimensional object model and the input image.

22. The image matching method according to claim 20, further comprising the steps of:

15 a step of finding a reference three-dimensional object model associated with the reference image similar to the input image;

a conversion step of squaring an input condition of the input image with that of the reference image by converting the input image and/or the reference image on the basis of the reference three-dimensional object
20 model; and

a step of retrieving the reference image associated with the input image by making a match between the input image and reference image squared in input condition.

23. The image matching method according to claim 22, wherein at
25 the conversion step, the reference image is previously converted, and an input condition of the input image is squared with that of the reference image.

24. The image matching method according to claim 20, comprising:
an image input step of inputting the input image;
a step of storing a plurality of representative three-dimensional
object models in a representative three-dimensional object model storage
5 section;
an image generation step of generating at least one comparison
image close in input condition to the input image every representative
three-dimensional object model on the basis of the representative three-
dimensional object models stored in the representative three-dimensional
10 object model storage section;
an image matching step of calculating a similarity between the input
image and each of the comparison images generated by the image
generation means, selecting a maximum similarity with respect to
comparison images associated with each representative three-dimensional
15 object model, and regarding the maximum similarity as a similarity
between the input image and the representative three-dimensional object
model;
a step of storing the reference images of objects in a reference image
storage section;
20 a step of storing similarities between the reference images stored in
the reference image storage section and representative three-dimensional
object models stored in the representative three-dimensional object model
storage section, in a reference image matching result storage section; and
a result matching step of extracting the reference image similar to
25 the input image on the basis of similarities between the input image and the
representative three-dimensional object models calculated by the image
matching means and similarities between the reference images and the

representative three-dimensional object models stored in the reference image matching result storage section.

25. The image matching method according to claim 24, further comprising:

5 a three-dimensional object model registration step of registering representative three-dimensional object models in the representative three-dimensional object model storage section;

 a reference image registration step of registering reference images in the reference image storage section; and

10 a reference image matching result update step of conducting calculation of the similarities using the image matching means, on a combination of a reference image and a representative three-dimensional object model newly generated by registration, when a new representative three-dimensional object model is registered in the representative three-

15 dimensional object model storage section by the three-dimensional object model registration means, or when a new reference image is registered in the reference image storage section by the reference image registration means, and adding a result of the calculation to results in the reference image matching result storage section.

20 26. The image matching method according to claim 24, wherein at the image matching step, a similarity between the input image and a representative three-dimensional object model is calculated every partial region,

 the reference image matching result storage section stores

25 similarities between the reference images stored in the reference image storage section and representative three-dimensional object models stored

in the representative three-dimensional object model storage section, every partial region, and

at the result matching step, the reference image similar to the input image is extracted on the basis of similarities between the input image and the representative three-dimensional object models calculated by the image matching means every partial region and similarities between the reference images and the representative three-dimensional object models, stored in the reference image matching result storage section every partial region.

27. The image matching method according to claim 24, wherein at the result matching step, similarities between similarities between the input image and the representative three-dimensional object models and similarities between the reference images and the representative three-dimensional object models are calculated, and in the calculation the resultant similarities are provided with weights on the basis of candidate precedence of similarities between the input image and the comparison images and the representative three-dimensional object models.

28. The image matching method according to claim 21, comprising:
an image input step of inputting the input image;
a step of storing a plurality of representative three-dimensional object models in a representative three-dimensional object model storage section;

an image generation step of generating at least one comparison image close in input condition to the input image every representative three-dimensional object model on the basis of the representative three-dimensional object models stored in the representative three-dimensional object model storage section;

an image matching step of calculating a similarity between the input image and each of the comparison images generated at the image generation step, selecting a maximum similarity with respect to comparison images associated with each representative three-dimensional object model, and
5 regarding the maximum similarity as a similarity between the input image and the representative three-dimensional object model;

a step of storing the reference images of objects in a reference image storage section;

a step of storing similarities between the reference images stored in
10 the reference image storage section and representative three-dimensional object models stored in the representative three-dimensional object model storage section, in a reference image matching result storage section;

a result matching step of extracting the reference image similar to the input image on the basis of similarities between the input image and the
15 representative three-dimensional object models calculated at the image matching step and similarities between the reference images and the representative three-dimensional object models stored in the reference image matching result storage section;

a step of storing reference three-dimensional object models
20 associated with the reference images stored in the reference image storage section, in a reference three-dimensional object model storage section;

a second image generation step of obtaining reference three-dimensional object models associated with reference images extracted at the result matching step, from the reference three-dimensional object model
25 storage section, and generating at least one second comparison image close in input condition to the input image every reference three-dimensional

object model on the basis of the obtained reference three-dimensional object models; and

5 a second image matching step of calculating similarities between the input image and second comparison images generated at the second image generation step, selecting a maximum similarity from among second comparison images associated with each of the reference three-dimensional object models, and regarding the maximum similarity as a similarity between the input image and the reference three-dimensional object model.

10 29. The image matching method according to claim 28, further comprising:

a three-dimensional object model registration step of registering representative three-dimensional object models in the representative three-dimensional object model storage section;

15 a reference image registration step of registering reference images in the reference image storage section; and

a reference image matching result update step of conducting calculation of the similarities using the image matching means, on a combination of a reference image and a representative three-dimensional object model newly generated by registration, when a new representative
20 three-dimensional object model is registered in the representative three-dimensional object model storage section at the three-dimensional object model registration step, or when a new reference image is registered in the reference image storage section at the reference image registration step, and adding a result of the calculation to results in the reference image matching
25 result storage section; and

a three-dimensional object model generation step of, in response to registration of a similarity between the reference image and the

representative three-dimensional object model in the reference image
matching result storage section conducted at the reference image matching
result update step, generating the reference three-dimensional object model
associated with the reference image by combining the representative three-
5 dimensional object models stored in the representative three-dimensional
object model storage section on the basis of the similarity, and registering
the generated reference three-dimensional object model in the reference
three-dimensional object model storage section.

30. The image matching method according to claim 29, wherein
10 at the three-dimensional object model generation step, a reference
three-dimensional object model associated with each reference image is
generated by combining representative three-dimensional object models
stored in the representative three-dimensional object model storage section
every partial region, on the basis of similarities obtained every partial
15 region between reference images stored in the reference image storage
section and representative three-dimensional object models stored in the
representative three-dimensional object model storage section, and the
generated reference three-dimensional object model is registered in the
reference three-dimensional object model storage section.

20 31. The image matching method according to claim 28, wherein
at the image matching step, a similarity between the input image
and a representative three-dimensional object model is calculated every
partial region,

the reference image matching result storage section stores
25 similarities between the reference images stored in the reference image
storage section and representative three-dimensional object models stored

in the representative three-dimensional object model storage section, every partial region, and

at the result matching step, the reference image similar to the input image is extracted on the basis of similarities between the input image and the representative three-dimensional object models calculated by the image matching means every partial region and similarities between the reference images and the representative three-dimensional object models, stored in the reference image matching result storage section every partial region.

32. The image matching method according to claim 28, wherein at the result matching step, similarities between similarities between the input image and the representative three-dimensional object models and similarities between the reference images and the representative three-dimensional object models are calculated, and in the calculation, the resultant similarities are provided with weights on the basis of candidate precedence of similarities between the input image and the comparison images and the representative three-dimensional object models.

33. The image matching method according to claim 22, comprising:
an image input step of inputting the input image;
a step of storing a plurality of representative three-dimensional object models in a representative three-dimensional object model storage section;

an image generation step of generating at least one comparison image close in input condition to the input image every representative three-dimensional object model on the basis of the representative three-dimensional object models stored in the representative three-dimensional object model storage section;

an image matching step of calculating a similarity between the input image and each of the comparison images generated at the image generation means, selecting a maximum similarity with respect to comparison images associated with each representative three-dimensional object model, and
5 regarding the maximum similarity as a similarity between the input image and the representative three-dimensional object model;

a step of storing the reference images of objects in a reference image storage section;

a step of storing similarities between the reference images stored in
10 the reference image storage section and representative three-dimensional object models stored in the representative three-dimensional object model storage section, in a reference image matching result storage section;

a result matching step of extracting the reference image similar to the input image on the basis of similarities between the input image and the
15 representative three-dimensional object models calculated at the image matching step and similarities between the reference images and the representative three-dimensional object models stored in the reference image matching result storage section;

a step of storing reference three-dimensional object models
20 associated with the reference images stored in the reference image storage section, in a reference three-dimensional object model storage section;

an image conversion step of obtaining reference three-dimensional object models associated with reference images extracted at the result matching step, from the reference three-dimensional object model storage
25 section, squaring an input condition of the input image with that of the reference image extracted at the result matching step by converting the input image and/or the reference image extracted at the result matching

step, on the basis of the obtained reference three-dimensional object models, and generating partial images respectively of the input image and the reference image squared in input condition with each other; and

5 a partial image matching step of calculating a similarity between the partial image of the input image and the partial image of the reference image generated at the image conversion step.

34. The image matching method according to claim 33, further comprising:

10 a three-dimensional object model registration step of registering representative three-dimensional object models in the representative three-dimensional object model storage section;

a reference image registration step of registering reference images in the reference image storage section; and

15 a reference image matching result update step of conducting calculation of the similarities at the image matching step, on a combination of a reference image and a representative three-dimensional object model newly generated by registration, when a new representative three-dimensional object model is registered in the representative three-dimensional object model storage section at the three-dimensional object
20 model registration step, or when a reference image is registered in the reference image storage section at the reference image registration step, and adding a result of the calculation to results in the reference image matching result storage section; and

25 a three-dimensional object model generation step of, in response to registration of a similarity between the reference image and the representative three-dimensional object model in the reference image matching result storage section conducted at the reference image matching

result update step, for generating the reference three-dimensional object model associated with the reference image by combining the representative three-dimensional object models stored in the representative three-dimensional object model storage section on the basis of the similarity, and
5 registering the generated reference three-dimensional object model in the reference three-dimensional object model storage section.

35. The image matching method according to claim 34, wherein
at the three-dimensional object model generation step, a reference three-dimensional object model associated with each reference image is
10 generated by combining representative three-dimensional object models stored in the representative three-dimensional object model storage section every partial region, on the basis of similarities obtained between reference images stored in the reference image storage section and representative three-dimensional object models stored in the representative three-
15 dimensional object model storage section, and the generated reference three-dimensional object model is registered in the reference three-dimensional object model storage section.

36. The image matching method according to claim 33, wherein
at the image matching step, a similarity between the input image
20 and a representative three-dimensional object model is calculated every partial region,

the reference image matching result storage section stores similarities between the reference images stored in the reference image storage section and representative three-dimensional object models stored
25 in the representative three-dimensional object model storage section, every partial region, and

at the result matching step, the reference image similar to the input image is extracted on the basis of similarities between the input image and the representative three-dimensional object models calculated at the image matching step every partial region and similarities between the reference
5 images and the representative three-dimensional object models, stored in the reference image matching result storage section every partial region.

37. The image matching method according to claim 33, wherein
at the result matching step, similarities between similarities
between the input image and the representative three-dimensional object
10 models and similarities between the reference images and the
representative three-dimensional object models are calculated, and in the calculation, the resultant similarities are provided with weights on the basis of candidate precedence of similarities between the input image and the comparison images and the representative three-dimensional object models.

15 38. The image matching method according to claim 20, wherein the object is a human face.

39. A program for making a computer execute an image matching method to retrieve a reference image similar to an input image, the image matching method comprising:

20 a step of making a match between the input image and a plurality of representative three-dimensional object models;

a step of making a match between the reference image and the representative three-dimensional object models; and

a step of retrieving the reference image similar to the input image
25 by using a result of the match between the input image and the representative three-dimensional object models and a result of the match

between the reference image and the representative three-dimensional object models.

40. The image matching program according to claim 39, the image matching method further comprising:

5 a step of finding a reference three-dimensional object model associated with the reference image similar to the input image; and

 a step of newly retrieving the reference image similar to the input image by using the reference three-dimensional object model and the input image.

10 41. The image matching program according to claim 39, the image matching method further comprising the steps of:

 a step of finding a reference three-dimensional object model associated with the reference image similar to the input image;

15 a conversion step of squaring an input condition of the input image with that of the reference image by converting the input image and/or the reference image on the basis of the reference three-dimensional object model; and

 a step of retrieving the reference image associated with the input image by making a match between the input image and reference image
20 squared in input condition.

42. The image matching program according to claim 41, wherein at the conversion step, the reference image is previously converted, and an input condition of the input image is squared with that of the reference image.

25 43. The image matching program according to claim 39, the image matching method comprising:

 an image input step of inputting the input image;

a step of storing a plurality of representative three-dimensional object models in a representative three-dimensional object model storage section;

an image generation step of generating at least one comparison
5 image close in input condition to the input image every representative three-dimensional object model on the basis of the representative three-dimensional object models stored in the representative three-dimensional object model storage section;

an image matching step of calculating a similarity between the input
10 image and each of the comparison images generated by the image generation means, selecting a maximum similarity with respect to comparison images associated with each representative three-dimensional object model, and regarding the maximum similarity as a similarity between the input image and the representative three-dimensional object
15 model;

a step of storing the reference images of objects in a reference image storage section;

a step of storing similarities between the reference images stored in the reference image storage section and representative three-dimensional
20 object models stored in the representative three-dimensional object model storage section, in a reference image matching result storage section; and

a result matching step of extracting the reference image similar to the input image on the basis of similarities between the input image and the representative three-dimensional object models calculated by the image
25 matching means and similarities between the reference images and the representative three-dimensional object models stored in the reference image matching result storage section.

44. The image matching program according to claim 43, the image matching method further comprising:

a three-dimensional object model registration step of registering representative three-dimensional object models in the representative three-dimensional object model storage section;

a reference image registration step of registering reference images in the reference image storage section; and

a reference image matching result update step of conducting calculation of the similarities using the image matching means, on a combination of a reference image and a representative three-dimensional object model newly generated by registration, when a new representative three-dimensional object model is registered in the representative three-dimensional object model storage section by the three-dimensional object model registration means, or when a new reference image is registered in the reference image storage section by the reference image registration means, and adding a result of the calculation to results in the reference image matching result storage section.

45. The image matching program according to claim 43, wherein at the image matching step, a similarity between the input image and a representative three-dimensional object model is calculated every partial region,

the reference image matching result storage section stores similarities between the reference images stored in the reference image storage section and representative three-dimensional object models stored in the representative three-dimensional object model storage section, every partial region, and

at the result matching step, the reference image similar to the input image is extracted on the basis of similarities between the input image and the representative three-dimensional object models calculated by the image matching means every partial region and similarities between the reference
5 images and the representative three-dimensional object models, stored in the reference image matching result storage section every partial region.

46. The image matching program according to claim 43, wherein
at the result matching step, similarities between similarities
between the input image and the representative three-dimensional object
10 models and similarities between the reference images and the representative three-dimensional object models are calculated, and in the calculation the resultant similarities are provided with weights on the basis of candidate precedence of similarities between the input image and the comparison images and the representative three-dimensional object models.

15 47. The image matching program according to claim 40, the image matching method comprising:

an image input step of inputting the input image;

a step of storing a plurality of representative three-dimensional
object models in a representative three-dimensional object model storage
20 section;

an image generation step of generating at least one comparison
image close in input condition to the input image every representative
three-dimensional object model on the basis of the representative three-
dimensional object models stored in the representative three-dimensional
25 object model storage section;

an image matching step of calculating a similarity between the input
image and each of the comparison images generated at the image generation

step, selecting a maximum similarity with respect to comparison images associated with each representative three-dimensional object model, and regarding the maximum similarity as a similarity between the input image and the representative three-dimensional object model;

5 a step of storing the reference images of objects in a reference image storage section;

 a step of storing similarities between the reference images stored in the reference image storage section and representative three-dimensional object models stored in the representative three-dimensional object model
10 storage section, in a reference image matching result storage section;

 a result matching step of extracting the reference image similar to the input image on the basis of similarities between the input image and the representative three-dimensional object models calculated at the image matching step and similarities between the reference images and the
15 representative three-dimensional object models stored in the reference image matching result storage section;

 a step of storing reference three-dimensional object models associated with the reference images stored in the reference image storage section, in a reference three-dimensional object model storage section;

20 a second image generation step of obtaining reference three-dimensional object models associated with reference images extracted at the result matching step, from the reference three-dimensional object model storage section, and generating at least one second comparison image close in input condition to the input image every reference three-dimensional
25 object model on the basis of the obtained reference three-dimensional object models; and

a second image matching step of calculating similarities between the input image and second comparison images generated at the second image generation step, selecting a maximum similarity from among second comparison images associated with each of the reference three-dimensional object models, and regarding the maximum similarity as a similarity between the input image and the reference three-dimensional object model.

48. The image matching program according to claim 47, the image matching method further comprising:

a three-dimensional object model registration step of registering representative three-dimensional object models in the representative three-dimensional object model storage section;

a reference image registration step of registering reference images in the reference image storage section; and

a reference image matching result update step of conducting calculation of the similarities using the image matching means, on a combination of a reference image and a representative three-dimensional object model newly generated by registration, when a new representative three-dimensional object model is registered in the representative three-dimensional object model storage section at the three-dimensional object model registration step, or when a new reference image is registered in the reference image storage section at the reference image registration step, and adding a result of the calculation to results in the reference image matching result storage section; and

a three-dimensional object model generation step of, in response to registration of a similarity between the reference image and the representative three-dimensional object model in the reference image matching result storage section conducted at the reference image matching

result update step, generating the reference three-dimensional object model associated with the reference image by combining the representative three-dimensional object models stored in the representative three-dimensional object model storage section on the basis of the similarity, and registering
5 the generated reference three-dimensional object model in the reference three-dimensional object model storage section.

49. The image matching program according to claim 48, wherein
at the three-dimensional object model generation step, a reference
three-dimensional object model associated with each reference image is
10 generated by combining representative three-dimensional object models stored in the representative three-dimensional object model storage section every partial region, on the basis of similarities obtained every partial region between reference images stored in the reference image storage section and representative three-dimensional object models stored in the
15 representative three-dimensional object model storage section, and the generated reference three-dimensional object model is registered in the reference three-dimensional object model storage section.

50. The image matching program according to claim 47, wherein
at the image matching step, a similarity between the input image
20 and a representative three-dimensional object model is calculated every partial region,

the reference image matching result storage section stores similarities between the reference images stored in the reference image storage section and representative three-dimensional object models stored
25 in the representative three-dimensional object model storage section, every partial region, and

at the result matching step, the reference image similar to the input image is extracted on the basis of similarities between the input image and the representative three-dimensional object models calculated by the image matching means every partial region and similarities between the reference
5 images and the representative three-dimensional object models, stored in the reference image matching result storage section every partial region.

51. The image matching program according to claim 47, wherein
at the result matching step, similarities between similarities
between the input image and the representative three-dimensional object
10 models and similarities between the reference images and the representative three-dimensional object models are calculated, and in the calculation, the resultant similarities are provided with weights on the basis of candidate precedence of similarities between the input image and the comparison images and the representative three-dimensional object models.

15 52. The image matching program according to claim 41, the image matching method comprising:

an image input step of inputting the input image;

a step of storing a plurality of representative three-dimensional
object models in a representative three-dimensional object model storage
20 section;

an image generation step of generating at least one comparison
image close in input condition to the input image every representative
three-dimensional object model on the basis of the representative three-
dimensional object models stored in the representative three-dimensional
25 object model storage section;

an image matching step of calculating a similarity between the input
image and each of the comparison images generated at the image generation

step, selecting a maximum similarity with respect to comparison images associated with each representative three-dimensional object model, and regarding the maximum similarity as a similarity between the input image and the representative three-dimensional object model;

5 a step of storing the reference images of objects in a reference image storage section;

 a step of storing similarities between the reference images stored in the reference image storage section and representative three-dimensional object models stored in the representative three-dimensional object model storage section, in a reference image matching result storage section;

10 a result matching step of extracting the reference image similar to the input image on the basis of similarities between the input image and the representative three-dimensional object models calculated at the image matching step and similarities between the reference images and the representative three-dimensional object models stored in the reference image matching result storage section;

15 a step of storing reference three-dimensional object models associated with the reference images stored in the reference image storage section, in a reference three-dimensional object model storage section;

20 an image conversion step of obtaining reference three-dimensional object models associated with reference images extracted at the result matching step, from the reference three-dimensional object model storage section, squaring an input condition of the input image with that of the reference image extracted at the result matching step by converting the input image and/or the reference image extracted at the result matching step, on the basis of the obtained reference three-dimensional object models,

and generating partial images respectively of the input image and the reference image squared in input condition with each other; and

5 a partial image matching step of calculating a similarity between the partial image of the input image and the partial image of the reference image generated at the image conversion step.

53. The image matching program according to claim 52, the image matching method further comprising:

10 a three-dimensional object model registration step of registering representative three-dimensional object models in the representative three-dimensional object model storage section;

a reference image registration step of registering reference images in the reference image storage section; and

15 a reference image matching result update step of conducting calculation of the similarities at the image matching step, on a combination of a reference image and a representative three-dimensional object model newly generated by registration, when a new representative three-dimensional object model is registered in the representative three-dimensional object model storage section at the three-dimensional object model registration step, or when a reference image is registered in the
20 reference image storage section at the reference image registration step, and adding a result of the calculation to results in the reference image matching result storage section; and

a three-dimensional object model generation step of, in response to registration of a similarity between the reference image and the
25 representative three-dimensional object model in the reference image matching result storage section conducted at the reference image matching result update step, for generating the reference three-dimensional object

model associated with the reference image by combining the representative three-dimensional object models stored in the representative three-dimensional object model storage section on the basis of the similarity, and registering the generated reference three-dimensional object model in the
5 reference three-dimensional object model storage section.

54. The image matching program according to claim 53, wherein
at the three-dimensional object model generation step, a reference three-dimensional object model associated with each reference image is generated by combining representative three-dimensional object models
10 stored in the representative three-dimensional object model storage section every partial region, on the basis of similarities obtained every partial region between reference images stored in the reference image storage section and representative three-dimensional object models stored in the representative three-dimensional object model storage section, and the
15 generated reference three-dimensional object model is registered in the reference three-dimensional object model storage section.

55. The image matching program according to claim 52, wherein
at the image matching means, a similarity between the input image and a representative three-dimensional object model is calculated every
20 partial region,

the reference image matching result storage section stores similarities between the reference images stored in the reference image storage section and representative three-dimensional object models stored in the representative three-dimensional object model storage section, every
25 partial region, and

at the result matching means, the reference image similar to the input image is extracted on the basis of similarities between the input

image and the representative three-dimensional object models calculated at the image matching step every partial region and similarities between the reference images and the representative three-dimensional object models, stored in the reference image matching result storage section every partial
5 region.

56. The image matching program according to claim 52, wherein
at the result matching step, similarities between similarities
between the input image and the representative three-dimensional object
models and similarities between the reference images and the
10 representative three-dimensional object models are calculated, and in the
calculation, the resultant similarities are provided with weights on the basis
of candidate precedence of similarities between the input image and the
comparison images and the representative three-dimensional object models.

57. The image matching program according to claim 39, wherein the
15 object is a human face.